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OBSERVATIONS ON SOME FRESH-WATER INFUSORIA.

With Descriptions of a Few Species Regarded as New.

D. S. KELLICOTT, PH. D., F. R. M. S., Buffalo, N. Y.

[PLATE II.]

At the two preceding meetings of this Society I have presented short papers giving some results of my observations on our fresh-water Infusoria. It has been my pleasure to continue the study of these animated atoms, and some of the facts thus ascertained are herewith presented for your consideration and criticism. I regret, more than any one else, that I cannot exhibit the animals themselves with their beauty and activity unimpaired, but they cannot be kept alive for an indefinite length of time, and I have failed in attempts at preserving them, at least, in a manner at all satisfactory. The drawings made to illustrate my descriptions were outlined, in most cases, under the camera, and I trust are truthful and helpful. I have spared no pains in verifying my conclusions by repeated observations; besides, I have often had the benefit of joint examination with my friend Dr. Lee H. Smith, and I hereby, with pleasure, acknowledge his assistance in clearing up many doubtful points. Moreover, I have tried to appreciate the difficulties of this line of study and the hazard in publishing conclusions in a field in which so many able investigators are engaged. In view of this I have been reluctant to name species; as a consequence, several of our characteristic forms have been named by others while I hesitated. In those instances where I have ventured to bestow a specific name I have, as a rule, taken care to state my reasons for regarding the species as distinct; if the reasons are not sufficient the synonyms are the result of error in judgment.

Within the last few years some notable fresh-water Infusoria have

PLATE II.

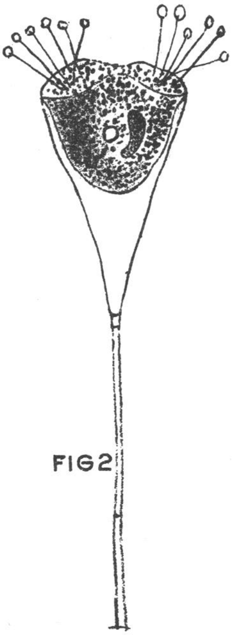
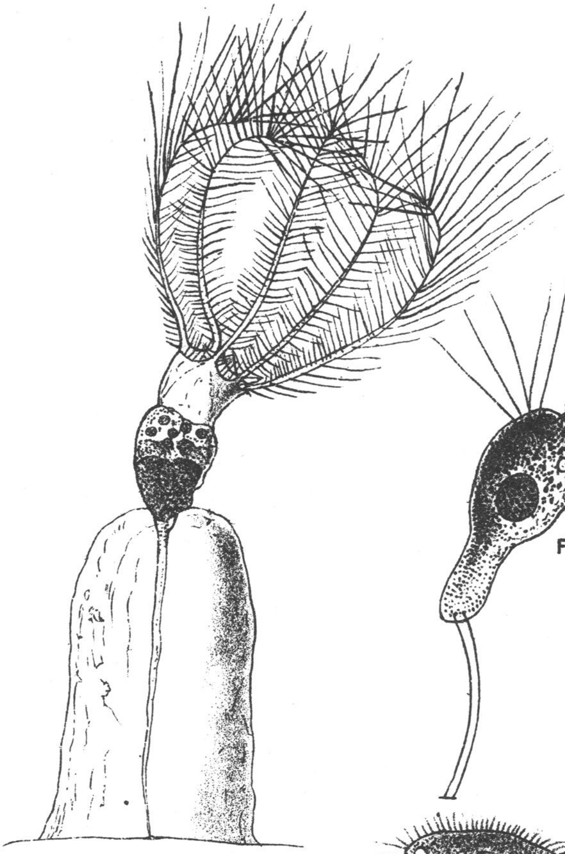


FIG 2



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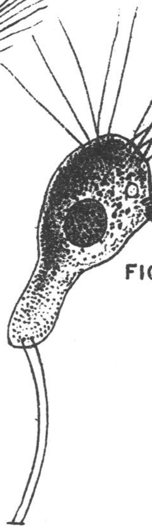

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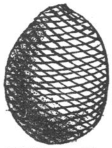
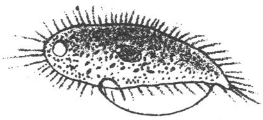
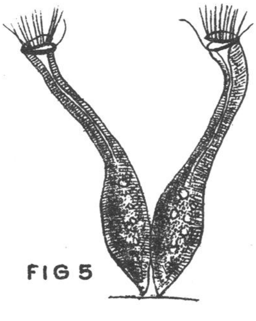


FIG 8





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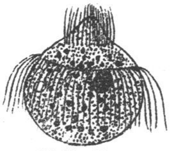

FIG 6

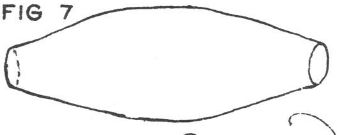

FIG 7

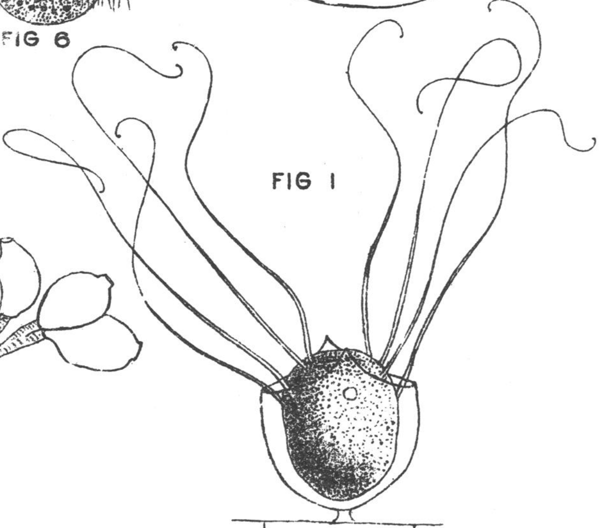

FIG 1

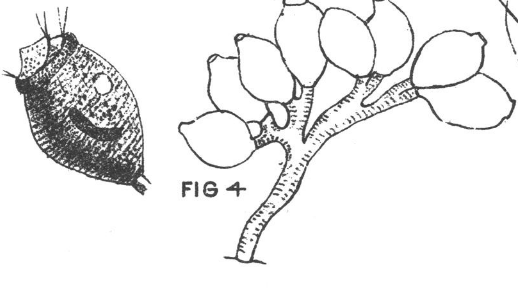

FIG 4

been discovered in this country. For example, *Vorticella vestita*, described by Dr. A. C. Stokes, which is completely surrounded by a cellular, hyaline vesture and, as demonstrated by Dr. Stokes, has two contractile vesicles—a character rarely possessed by a vorticellid. This lovely species I have recently obtained plentifully, attached to *Ceratophyllum*, from Scajaquada Creek, Buffalo. Another recent species of especial interest is *Epistylis ophidioidea* from the same stream, described in *The Microscope*, volume iv., 248. It is one of the most bulky vorticellids known; it is remarkable alike for the unusual structure of the zooids and the luxuriance of the colony growth ; but the most noteworthy feature, however, is the two distinct types of zooids ; mingled with the hosts of ordinary individuals there are a few strangely modified ones; their bodies are greatly elongated, snake-like in form and motion. The significance of this modification has not been made apparent, it probably has some relation to the reproduction of the species. It has recently been taken attached to aquatic plants in deep, pure water of the Niagara. I never recur to this infusorium without feeling deeply sensible of the inadequacy of my account of it. Numerous other distinct and unique forms could be mentioned, which demonstrate that there is much of deep interest in our fresh-water infusorial fauna to reward research.

I can but think that the species of Tentaculifera are not well represented in the vicinity of my studies. I have encountered a few representatives of this most highly developed group of the Legion, which are not mentioned in the list printed in the Proceedings of the Rochester meeting. The following I regard as worthy of distinct rank and name as species:

1. *Acineta cuspidata*, *n. s.* (fig. 1). The body is spheroidal or sub-cylindrical, not completely filling the lorica and projecting a little above the rim in most examples; the long, flexible, extensible tentacles arising from two opposite sides of the body are few in number and slightly thickened at the extremity. The lorica is hyaline, cup-shaped, with two long points or cusps on the edge, one on either side between the extended arms. Contractile vesicle single. Pedicle short. Height of lorica $\frac{1}{800}$ to $\frac{1}{600}$ of an inch.

I first found the species attached to *Œdogonium* collected in a deep swamp at Point Abino, Ontario, June 7, 1885. To my surprise its tentacles were soon seen to be extending with a writhing, searching motion like that of the arms of the common Hydra. This beautiful atom, therefore, is closely allied to the marine species *A. dibdalteria.* Subsequent examination may demonstrate that it would be more properly classified with Kent's genus *Actinocyathus.*

2. *Acineta flava, n.s.* (fig. 2). The lorica is triangular, compressed and very finely striated longitudinally. The body is not adherent, usually occupying the anterior half of the shell, in some instances nearly the whole cavity; color yellowish-brown, in young specimens green, parenchyma filled with coarse granules. The two antero-lateral fascicles composed of comparatively few, short tentacles which are distinctly capitate. Contractile vesicle sub-central. Endoplast thick, slightly curved. The pedicle is slender, of uniform diameter, a little longer than the lorica, straight or slightly curved; the lorica is attached to the stalk by a short, flexible piece which permits it to be moved freely back and forth. Length of lorica $\frac{1}{260}$ of an inch.

This species has been known to those who examine *débris* from the Buffalo water-supply for a long time; it is found free therein in the winter; its color then is precisely that of the very abundant diatom, *Stephanodiscus Niagaræ,* with which it is associated. Recently I have taken it attached to *Cladophora glomerata* from the Niagara; on this support it is sometimes green; the green ones I have taken to be the younger examples. I may not have seen the tentacles fully extended; if so, they are only about half as long as the body. It is an unusually sensitive species. A few taps on the compressorium are sufficient to cause the retraction of the tentacles so that they scarcely appear above the rim of the lorica as short pins stuck into a cushion, and, as it appears to me, under such irritation, when the lorica is made to roll over by motion of the cover, the compressed lorica is still more strongly flattened, the body is then pushed far down towards the bottom of the cup. This acinetan agrees in the outline of its domicile with that of *Grandis,* and also in occupying the anterior part of the same. On the other hand, it is less than half as large as that species. The parenchyma is not transparent and finely granular, but opaque, coarsely granular and colored; the pedicle is relatively much shorter and the tentacles are few instead of numerous. The short, flexible joint by which the lorica joins the stalk is also a feature of difference.

3. *Podophrya diaptomi, n. s.* (fig. 3). Body pyriform, elongate, plastic; parenchyma transparent, with rather coarse granules in the anterior moiety, finely

granular posteriorly. Tentacles not distinctly capitate, arranged in three fascicles, numerous,—about forty in each lateral bundle,—long and slender. Endoplast spheroidal or ellipsoidal; under high magnification it appears beautifully granular; in younger examples the granules are very much coarser. Contractile vesicle, single, situated near the upper edge of the base of middle fascicle. Peduncle half as long as the body to equal its length, slightly curved, uniform diameter, striate with the body attached obliquely. Length of body, $\frac{1}{200}$ of an inch.

It is found in the winter in great abundance, attached to *Diaptomus sp.* in the Buffalo water-supply. The young are nearly spherical, and their few tentacles are not in fascicles, but irregularly scattered. The animal is usually attached to the body rings of its host, frequently on the upper surface, more often on the under side.

The species is sufficiently distinct from those said to occur on the fresh-water Crustacea.

I have previously reported finding the remarkable Tentaculate, *Dendrocometes paradoxus;* I am now able to report that its near neighbor, and a no less remarkable species, *Dendrosoma radians*, occurs also in waters about Buffalo. I obtained it for the first time in some abundance, and very large examples of it, July 25, on *Myriophyllum* and *Vallisneria* from Scajaquada creek at Black Rock.

In the same collection as the above, *Podophrya quadripartita* was not uncommon, especially on the pedicles of different vorticellids. Among these a number were observed inclosing large, ciliated embryos, one of the forms of reproduction frequently observed by others. These are nearly spherical, occupy the anterior part of the parent's body, between the four tentacular lobes and just beneath the upper.or anterior cuticular layer. Below the embryo the endoplast is plainly seen; I was unable to make out that it became striate or fibrilate or in any manner differed from its usual granular character, as reported to do at the time of partition, by Bütschli; several embryos were seen to escape and swim away too rapidly to be followed; a motion of the parent from side to side, reminding one of an alternate shrugging of the shoulders, precedes the exclusion; this action becomes more marked, when finally the ciliated globule, in an instant, passes through the anterior cuticular wall, where there appears to be a specially-formed aperture, and is gone. Those noted as giving rise to young were the variety which is greatly attenuated posteriorly.

In the same gathering there was still another interesting member of this group, viz.: *Acineta mysticinia*, variety *longipes*. The figure of this variety in Kent's Manual represents the pedicle as stouter than it is; in fact, the variety is more attenuate and far more elegant than it is represented to be. I have long known the short-stalked form, and it is not easy to believe that the two are one species. There was a multitude of them on the *Vallisneria*, affording an opportunity to study the motion of the tentacula; the rapid withdrawal and shooting out of these organs were witnessed, but that they were when fully extended capable of flexure in various directions as attested by Mr. F. W. Phillips, I was not successful in demonstrating. Still I may add in this connection that a form, common enough with *Longipes*, which was taken for the young of *P. quadripartita* with two fascicles of tentacles only, exhibited the flexibility of their tentacles in a marked degree, not, however, so much when fully extended as when partly contracted.

Podophrya cothurnata.—I have recently identified this beautiful *Podophrya;* it was taken from a pond mantled with *Lemna*, mingled with *Wolffia*. Our examples accord well with Claparède's figure except that the stout, short pedicle is conical and not cylindrical as drawn by that author. The many contractile vesicles were often seen to collapse all at the same time like the discharge of a "comrade battery;" then slowly to again develop, some faster than others; when all were expanded, another general collapse would follow.

Platycola intermedia, *n. s.* Lorica ovate, depressed, prolonged anteriorly into an obliquely elevated neck, much shorter than in *P. longicollis* and not funnel form, as in that species, not everted, outline of aperture elliptical, color light brown, attached to Confervæ in spring. Length of lorica $\frac{1}{580}$, $\frac{1}{240}$ of an inch.

I have mentioned and figured the lorica of this species (Proceedings Rochester meeting, A. S. M., page 121, pl. iii., fig. 8); it was regarded as a variety of *P. longicollis*, but on account of its shorter, not funnel-shaped neck, and smaller size, I think it is specifically distinct.

The various species of the genus *Opercularia* are among the most attractive of the Vorticellidæ. The genus is unusually well represented in our fresh waters. I have detected nearly all the described fresh-water forms, besides the following characteristic species have been added to the list within the past year: *O. elongata, rugosa, plicatilis* and *constricta.*

Epistylis cambari, n. s. (fig. 4). Body broadest at the middle, slightly gibbous, somewhat attenuate posteriorly and narrowed anteriorly; length about once and a half the width; border thickened, cord-like, cuticular surface transversely striate, under a high power the striæ easily resolved into beads; body of contracted zooid globular with well marked snout-like projection; the ciliary disc is narrow, width little more than half that of the peristome border, conical in form like that of *Umbilicata*; the ciliary wreath is not powerful. Pedicle stout, more or less bent in large colonies transversely striate, usually branching on one side only, or secund; very many zooids in a colony. Endoplast curved more or less nearly vertical. Length of zooid $\frac{1}{500}$ of an inch. On gills of different species of *Cambarus* in the Niagara river.

I read a note on this *Epistylis* at the Chicago meeting of the Society; subsequent examination of it has convinced me that it differs materially from described commensal species, so I have proposed an independent name for it. I have elsewhere spoken of its abundance, I may add that crays dragged up with weeds in mid-winter carried vast numbers of them in the branchial cavity. The disc, which resembles in shape so closely grandmother's tea-pot-lid, allies the species to *Umbilicata*, but the totally different shape of the body and the very different pedicle clearly separate them.

Vorticella rhabdostyloides, n. s. Body nearly globular, cuticular surface smooth, peristome border thickened, narrow, cilia relatively stout, endoplast thick, short and but slightly curved. When contracted the body becomes more nearly globular or even depressed until it is napiform. The pedicle is filiform, length about equaling that of the body; length of body $\frac{1}{900}$ to $\frac{1}{800}$ of an inch.

This vorticellid is plentiful during the winter months attached singly to floating diatoms in Niagara-water. It appears to prefer *Stephanodiscus Niagaræ*, which support, if it may be so called, it tows about by the activity of its cilia. I have called it *Rhabdostyloides*, from the fact that the shorter-stalked examples are so reluctant to contract their pedicles; sharp blows upon the cover glass do not always induce this movement; it then has much the appearance of a species of *Rhabdostyla.* The pedice when contracted is thrown more or less into a zigzag than into a coil, as is usual with members of the genus.

The animal is not unlike *R. ovum*, but is more nearly spherical and very different when contracted with the contractile vesicle more nearly in the center of the body. The peristome-border and pedicle separate it with sufficient sharpness from the only spherical form which it approaches in size.

Gerda sigmoides, *n. s.* (*fig. 5*). Body very flexible; when fully expanded it is four to six times longer than the greatest width, the posterior third is ovate, tapering nearly to a point, the anterior two-thirds are long, neck-like, gracefully curved, giving the animal a sigmoid outline; the surface is delicately striate transversely; when made to contract strongly by tapping on the cover-glass the body exhibits a few annulations at the extremities; in a few cases longitudinal folds or grooves of the posterior part have been witnessed. The peristome-border is somewhat wider than the "neck" and but slightly thickened; the disc is moderately elevated, slightly convex; cilia normal, vestibular seta distinct. The contractile vesicle is small and situated just above the expanded part of the body. Length of expanded zooid $\frac{1}{180}$ to $\frac{1}{160}$ of an inch. Occurs on Confervæ from ponds.

This very attractive vorticellid was usually seen in pairs as represented in the figure. It was taken only in one pond or puddle from which the water had disappeared by the middle of June. Compared with published descriptions and figures of other species it is clearly distinct.

Spirochona tintinnabulum, Kent. This is an elegant species, an account of which occurs in Kent's Manual of the Infusoria; it occurs in England on the epidermis and branchial appendages of young newts, *Triton cristata.* I am prepared to announce its occurrence in this country on the gills of the young of the spotted triton, *Diemyctylus viridescens.* The cuticle proves to be finely and transversely striated, agreeing with Kent's description rather than with his figure, which represents it as coarsely striate or annulate. I was favored by an opportunity to witness its subdivision by transverse fission as recorded by its describer.

Mesodinium recurvum, *n. s.* (fig. 6). Body globose, the snout-like process being short; surface smooth; parenchyma inclosing a few large, green granules. At the beginning of the anterior third there arises a cincture of cirrate cilia which are bent backwards extending below the middle third of the body. Above this circle there is a wreath of long, filamentous, oral cilia. Oral aperture in a short anterior prolongation. The single contractile vesicle is situated near the middle of one side of the body. The endoplast is oval, placed subcentrally. Pond-water among algæ; seen thus far only in early spring.

This species in its habits is quite like its relatives. It swims with the swiftness of *Strombidium Claparèdi* with which it was found associated, and leaps like *Halteria grandinella*, another associate. It darts about the field too rapidly to be followed, until it finds congenial relations for feeding or other pleasure, when it comes to rest, usually standing, with mouth down, and the cirrose cilia stand out a little way from the body so that when one looks down upon it, it is seen surrounded by a formidable *cheval de frise*. When thus apparently feeding it turns on its vertical axis first to right and then to left with a slow motion now and again accelerated until it spins with a velocity that defies the eye to follow.

The close resemblance of this species to *Halteria volvox* of Eischwald one cannot fail to notice, but the absence of the long, straight, springing hairs, and the not eccentric mouth "associated with a spiral or subcircular wreath of long cirrose cilia" separate it unmistakably from *Volvox* and the genus *Halteria*. Nor does it well agree with the terms of the genus *Mesodinium*, inasmuch as it has a wreath of long cilia about the anterior process. But I recall that the same feature has been noted in *M. acarus* by W. S. Kent, and that Claparède and Lachmann have figured *M. pulex* with three bristle-like cirri in advance of the mouth. It is certainly too far removed, if I have correctly made out its structure, from any other genus of the Halteridæ. So for the present I have thought it best to refer it to *Mesodinium*.

Strombidium oblongum, *n. s.* Oblong, nearly cylindrical, rounded posteriorly, somewhat constricted below the peristome region, surface smooth, parenchyma transparent, usually inclosing a few green corpuscles. The oval cirri powerful, half as long as the body; posteriorly several scattered, trailing hairs or gubernacula; these equal in length the body; a few fine cilia on the central part of the body [these may prove to be confined to the ventral surface, as in *S. acuminatum*]. The contractile vesicle anteriorly situated. Abounds in ponds; especially abundant among grass and weeds covered with the mucilaginous *Cœthophora elegans*.

This *Strombidium*, while a rapid swimmer and one that leaps about, when occasion demands it, after the manner of its kind, is after all a comparatively quiet animal; it may remain quietly feeding or slowly moving about its sweet morsels for some minutes, when, if aroused, it will dart away with an energy indicated by its powerful adoral wreath.

Unfortunately, the card containing the sketch and measured dimensions was lost before a record was made in my note-book.

Diplospyla inhæsa, gen. et sp. nov. (fig. 7). This infusorian, which, I think, is new and a type of a distinct genus, was obtained in swamp-water among algæ at Point Abino, Ontario, June 7, 1885. It inhabits a membranous tube open at both ends, and when feeding does not protrude its body from the tube, but gathers its favorite morsels from the water passed through its sheath by the action of its cilia and undulating membrane. In this habit it is unique. Perhaps the tube dweller, *Oxytricha tubicola*, of Gruber has a similar peculiarity, and I cannot but suggest that species may belong in the same genus with the present one, although the latter is by no means an *Oxytricha*. It is a restless creature seldom remaining more than a brief time in any favorable position for study. Its almost ceaseless motion consists in turning over and over, then reversing the motion and finally turning about and reversing the direction of the water current in the tube. It cannot by coaxing or by force be induced to desert its protecting sheath; pressure, stale water and reagents were all tried without success. The only one which I have seen free swimming was a brand new one resulting from subdivision; so my observations were accordingly made through the walls of the membranous sheath, which, fortunately, is quite transparent and usually free from adhering dirt.

Its structure, as I have been able thus to make it out, allies it to the Lembidæ, although at present no representative of the family is a tube-dweller. It is referred provisionally to that group. Its generic characters may be expressed as follows :

Diplospyla. Animalcules inhabiting a membranous sheath, or lorica, which is open at both ends, ovate, elongate, flexible; oral aperture, undulating membrane and contractile vacuole as in *Lembus*.

D. inhæsa. Body ovate, somewhat pointed anteriorly, less than twice as long as broad. The body cilia are rather fine and long. The oval aperture is situated posteriorly to the center of the body; the undulating membrane situated in a groove extending from a short distance back of the anterior border to the mouth; seen from the side, the membrane, when fully extended, appears nearly semicircular; the adoral cilia are stouter than the body cilia situated at base of membrane; posteriorly there are a few setose cilia, apparently without the power of moving. Endoplast ovoid, situated in front of the oval aperture. Contractile vesicle small, pulsating slowly, near the posterior border. The parenchyma is transparent, sometimes with green bodies that obscure its transparency. Length of zooid, $\frac{1}{800}$ of an inch.

The sheath is hyaline, length $\frac{1}{140}$ to $\frac{1}{120}$ of an inch, contracted at both ends so that the openings equal about one-half the greatest width. Attached by the side to filamentous algæ in swamp-water.

I have witnessed the self-division of the animal which takes place transversely. After the median constriction was first noticed the time required for complete separation was a little more than one hour. One moiety soon escaped from the tube.

One of the associates of this species was the remarkable flagellate *Mallomonas Plosslii*, Perty. It was not uncommon.

Trachelomonas torta, n. s. (fig. 8). Lorica egg-shaped, colorless, ornamented by oblique rugosities, giving the shell the appearance of having been twisted. Animal of the usual green color with red eye-spot. Aperture situated in a short, oblique groove. Flagellum very long Contractile vesicle anteriorly placed. Length of lorica $\frac{1}{500}$ in.

Park Lake, in June, associated with *Phacus triqueter, P. longicandus* and many examples of Ciliata.

T. volvocinia is common in ponds and streams about Buffalo. A rarer form, which is a little smaller and has a shell covered with oblique wrinkles, appears to be *Rugulosa.* Mr. C. M. Vorce, some years since, sent to Mr. Henry Mills numerous examples of it, taken, as I understood, from the Cleveland water-supply. *T. hispida* is also known to me. The so-called variety, characterized by a short, anterior, tubular neck, may be *Leguncula piscatoris*, described by Mr. J. H. Fisher, vol ii., Proc. of this Society. I am inclined to think that the latter is distinct; if so, it should be known as *Trachelomonas piscatoris*, Fisher.